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technology, trends, products, and solutions for forensic professionals

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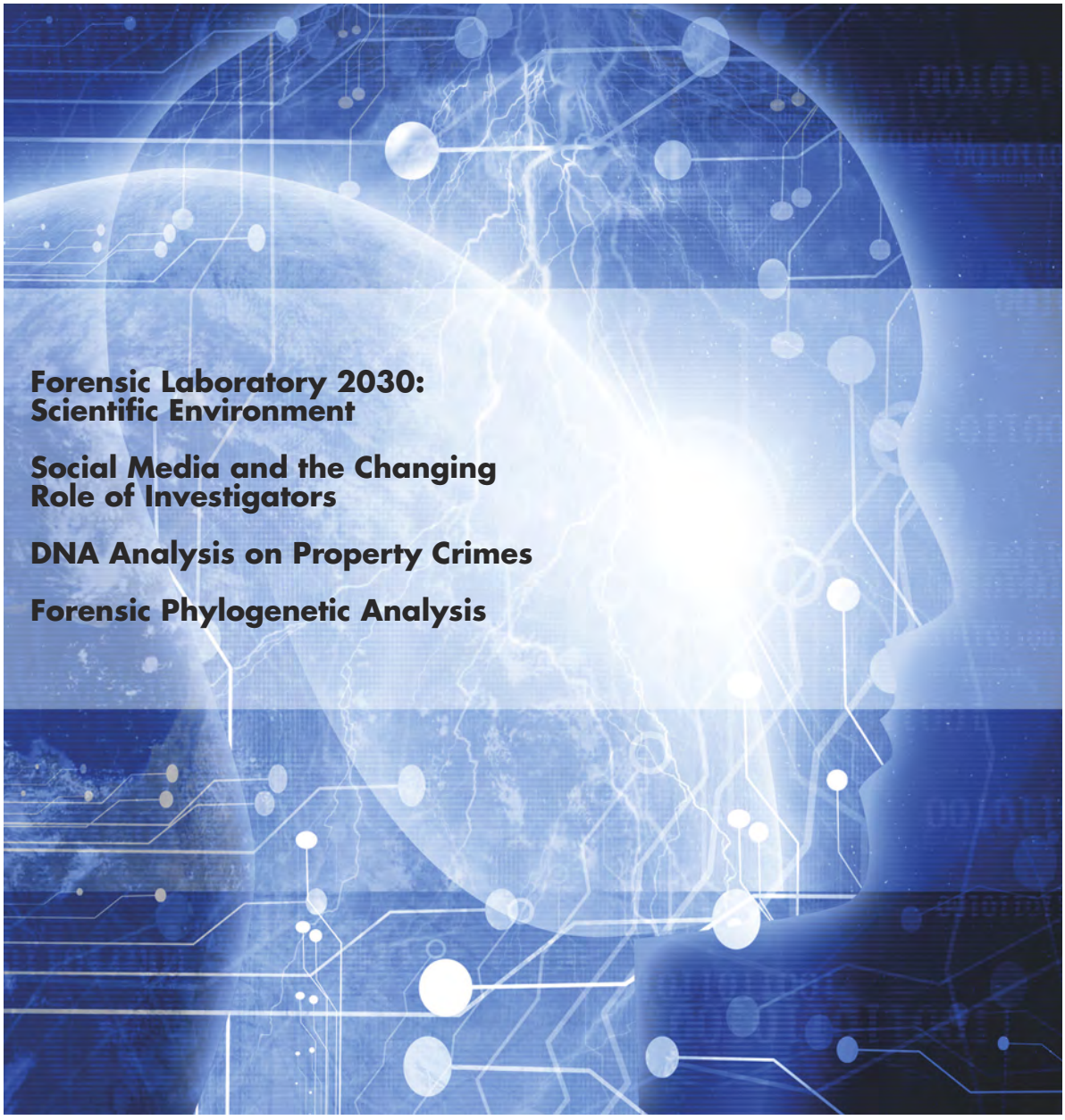

Forensic Laboratory 2030: Scientific Environment

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from the editor

The Future of Forensics

In each issue of *Forensic Magazine*, we try to bring you information about new technologies, techniques, and ideologies in the field of forensics. This issue is no exception with Douglas Page's look at forensic phylogenetic analysis to investigate cases of intentional HIV transmission, Benjamin Wright's article on social media and how it is changing the role of investigators, as well as another look at DNA testing in property crime cases.

With the new year around the bend, we've decided to take a more specific look at what the future may hold with Mike Mount and Steve Hackman's article on the future of facility design, "Forensic Laboratory 2030: Scientific Environment." SmithGroupJJR undertook an extensive survey polling crime lab directors and managers throughout the country over a two year period with an online survey and personal interviews to inquire into the changes in the industry and where they might lead us over the next 15 to 20 years. While congress has yet to act on the recommendations of the 2009 NAS report on the state of forensic science, they have also considered the changes that may result from future rulings as well as lab-initiated implementation of these suggestions. Their findings are laid out in what will be a four part series, to be continued in our Forensic Daily newsletter.

I'm sure you've all noticed trends in your own laboratories that provide clues to what the future may hold. An increased focus on digital forensics and DNA analysis as other forensic specialties fall by the wayside. A move toward greater degrees of automation, the use of new technologies, and the trend toward smaller workforces have also been evident. Mike and Steve take a look at these trends and what they might mean to your facility and new facility projects. However, we can extrapolate further as to the effects this will have on how you perform your job in the future, training you may want to consider, and technology you will soon become familiar with. While change can be overwhelming, it is important to stay ahead of the curve to do your job effectively.

We'd love to hear your thoughts on both this article and the future of forensics. What changes do you see coming down the road? While progress is inevitable, are we moving in the right direction? Do we need to reconsider our approach? Join in the conversation in our online community on LinkedIn or drop me a line at rwaters@forensicmag.com. **-Rebecca Waters**

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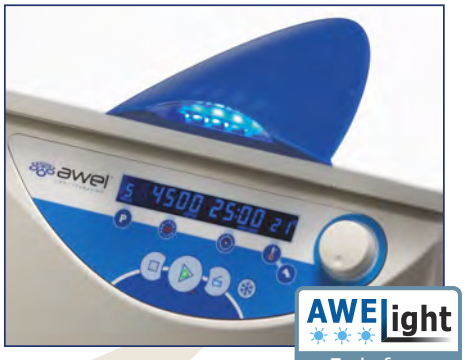

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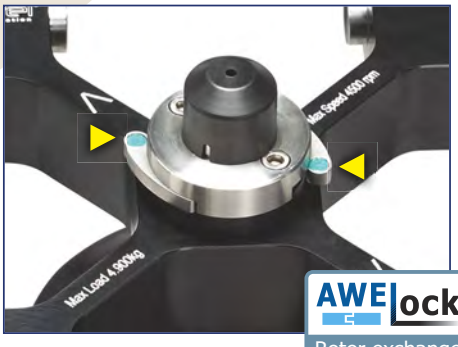

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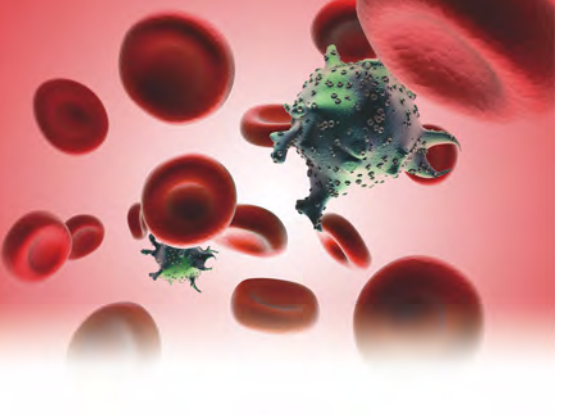

Forensic Phylogenetic Analysis: Under the Microscope

Experts search for best way to present phylogenetic findings to a jury

Douglas Page

In 1994, in Sweden, phylogenetic analysis was first used in court to help obtain a conviction in a case of HIV transmission. Since then, phylogenetic analysis—sometimes given the misnomer "HIV fingerprinting"—has been used repeatedly in world courts to try cases of deliberate HIV transmission—cases where a person is charged with deliberately infecting another with the HIV virus, either through unprotected sex, dirty needles, or blood exchange.

As with most scientific evidence, the best way to present phylogenetic findings to a jury is still evolving. Experts themselves don't always agree.

Viral Pedigree

Molecular phylogenetics is a means by which the genealogical pedigree of micro-organisms can be reconstructed from information found mostly in their DNA. The most common forensic use is for tracing or dating transmission of viruses. If organisms can be shown to share a common ancestor, this information may be forensically useful, especially in cases involving intentional HIV transmission.

"Many viruses have high rates of evolution, so there are enough genetic changes in the viruses that they can be followed through time and across transmission events," said David Hillis, a professor of Integrative Biology, University of Texas.

Forensic phylogenetic analysis works like this. Blood samples are collected from individuals in question, as well as from a control group. The samples are coded, blinding the study to investigators. Viruses are extracted from the blood and DNA and RNA sequences are obtained from the viruses. The analysis, which takes a few days, is usually performed by an expert in phylogenetic analysis and computational biology. That expert, who only knows which samples are the controls, determines if one of the test samples can be identified as being consistent as the transmission source. This is done by determining if a recipient shows a phylogenetic subset of the sequence variation present in the source. Once a determination is made, identities are decoded and the results found to support or refute charges.

In a 2010 paper (*Proc Natl Acad Sci* 2010 Dec 14), Hillis said phylogenetic methods are ideally suited for determining the HIV pattern of descent in cases of suspected transmissions, and that phylogenetic analysis can also provide evidence about the direction of transmission. Direction of transmission is supported by a phenomenon called paraphyletic relationship—where a subset of source viral sequences is more closely related to all recipient sequences than to other source sequences.

"Strongly supported paraphyly can provide evidence to infer direction of transmission between pairs of epidemiologically related individuals," Hillis said. "However, a lack of paraphyly cannot be used to refute a possible transmission route."

Hillis, and others, caution, however, there is much potential for abuse in current phylogenetic analysis methods. It is inappropriate, for example, to use phylogenetic analysis to survey databases to look for closest matches, and then use that information to make transmission accusations. Phylogenetic analysis is not like a DNA fingerprint, in that there is no expectation of an exact match between transmission pairs.

Phylogenetic Indictment

Shortly after the Hillis paper appeared, European medical researchers made the claim that evidence obtained through phylogenetic analysis can never be conclusive, in that the conclusions do not preclude

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You hear about it everyday—you know that DNA analyses are used to convict criminals, but it also exonerates, identifies missing persons, and rapidly identifies persons of interest at the onset of criminal investigations. The technology has become the mainstay of criminal investigations to find the truth. It has enabled law enforcement agencies to provide unquestionable data in court cases on those involved in criminal activities and on those who were not involved as well. And now enhanced DNA analysis technologies give crime labs and investigators ways to reduce their workloads and investigative budgets.

Enhanced DNA analysis technologies give crime labs and investigators ways to reduce their workloads and investigative budgets.

While established DNA technologies provide unquestionable truths, those same advantages can threaten crime labs with increasingly massive backlogs for DNA analyses submitted by crime scene investigators. And in these times of tough fiscal constraints, these backlogs can increase the costs that crime labs can ill afford. Nor can society afford the effects of these DNA analysis backlogs which can extend the time from criminal charges being made to the beginning of trial proceedings.

To solve these multiple challenges, crime labs often choose to outsource their DNA analysis work. Outsourcing of DNA analyses, however, is not just a matter of speed, cost-effectiveness and work efficiencies. DNA analysis service providers are regularly put into positions for testing critical pieces of evidence where the analyzed items can make or break an investigator's high profile case. Not only does the service provider have to do everything possible to provide quality results, they have to ensure that the analysis is being done in a manner that will not be questioned in court. And by ensuring this is being done right every single time, DNA analysis service providers are able to maintain their status as highly trusted DNA labs. This also enables the crime labs to be confident that they're receiving high-quality, reliable results when they submit their evidence—win-win situations for analysis providers and crime labs.

A perfect example of this is the forensic labs operated by the Maryland State Police who spent a lot of time processing DNA samples where the lead time for court cases—waiting to receive DNA analyses—often exceeded eight months. Following implementation of a program that enables law enforcement agencies to directly outsource certain cases for their DNA analyses to Bode Technology, this lead time was reduced to just 60 days and often less.

But while quality, reliability and accuracy of DNA analyses are the hallmarks of a number of reliable outsourcing organizations that provide results to be used in court cases, new innovations that dramatically improve the timeliness for obtaining these results has become a characteristic of just one company—Bode Technology. Bode recently introduced a series of services that both streamlines DNA analyses for crime labs and looks to transform the ways that investigators will process their evidence in the future.

To increase crime lab capacity, Bode introduced BodeDirect Outsourcing where evidence is sent directly to Bode for processing after obtaining pre-approval from a CODIS laboratory. Evidence samples are not even entered into a crime lab's database until the eligible results are reviewed, saving valuable time for evidence technicians and

DNA

reducing the administrative burden on the department. To help investigators solve cases early in an investigation, Bode introduced Same-Day DNA Service which provides forensic DNA analysis and a court-ready report the same day that the evidence is received at the service lab. And this doesn't just apply to a limited range of evidence samples, it applies to a full range including blood, saliva and touch samples.

But to aid investigators in near real-time situations, Bode introduced its Rapid DNA Service. With this service DNA profile results can be provided in less than 90 minutes from the time it's received from both evidence and reference samples! Through this completely validated service, samples can be compared and an investigative lead can be developed within hours of the onset of an investigation. In the event there is an unexpected reveal in a court case in the morning lawyers can have DNA analyses with a court-ready report provided and submitted as reliable evidence in that same case in less than 24 hours, or DNA profile results right after lunch to aid immediate additional investigation through Same-Day DNA Service and Rapid DNA Service, respectively. Bode's Same-Day DNA Service has been validated to meet the FBI's Quality Assurance Standard and can be defended in court.

Creating a Global DNA Environment

Much of the established world recognizes and utilizes DNA analysis technologies to support their cultural systems—DNA databases continue to be developed to help identify criminals and their patterns of behavior. Most third-world countries don't have the infrastructure, tools or knowledge to create that type of a support system. As a result, most third-world country crimes are limited in their ability to be prosecuted. Criminals are free to continue their illegal activities. Rape can be used as political weapon and massive crimes against humanity can go undetected for decades.

Armed with his company's DNA technologies, Bode's Vice President of International Development, Ed Huffine is on a mission to change those situations. Visiting two to three new countries each month, Ed works to educate third-world administrators on the science of DNA, what the technologies can do and how the analyses can be applied. "Each country I visit has a different particular need and no two countries are identical," says Huffine.

Implementing DNA analysis technologies into a third-world country works to build the safety and security for that nation. It ensures that criminal activities can be successfully prosecuted and those who are innocent are exonerated. The time frame for these investigations is also nearly unlimited. For example, in 1984, units of the Peruvian Army executed 123 men, women and children. Nearly 30 years later, scientists used Bode Technology to identify these victims through the DNA analysis of their skeletal remains. DNA technologies have also been used to identify acts of genocide in Bosnia.

"We live in the Golden Age of DNA analysis," says Huffine. This technology has the ability to save lives, save money, and transform society.

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reasonable doubt.

In an editorial in the February 2011 issue of *The Lancet*, six European researchers agreed that phylogenetic analysis is a powerful technique that can, if properly used, provide valuable circumstantial evidence in HIV transmission cases. However, forensic scientists should be aware of the limitations of this analysis and emphasize that courts must use ancillary evidence to achieve convictions.

Anne-Mieke Vandamme, of the Laboratory for Clinical and Epidemiological Virology, Rega Institute for Medical Research at the Katholieke Universiteit, Leuven, Belgium, told *Forensic* that phylogenetic evidence is never conclusive.

"Phylogenetic evidence is at best circumstantial and it is at its strongest when the evidence is against the case," she said.

Vandamme maintains that when phylogenetics finds a monophyletic cluster joining victim and suspect, this evidence cannot prove transmission beyond reasonable doubt. Proper identification of the transmission source would require that a phylogenetic tree can flawlessly reconstruct a true epidemic history and that strains from all patients ever infected with HIV are available as controls—both unrealistic assumptions.

Thus, since the full transmission tree cannot be known, no proof of direct transmission can be claimed. Conversely, separate clustering with unlinked individuals can disprove direct transmission.

Science in Court

Hillis responded that *The Lancet* editorial authors criticized "HIV fingerprinting," which is not the same as phylogenetic analysis. HIV fingerprinting attempts to identify a specific HIV sequence, not to reconstruct a transmission history.

"They also greatly over-stated the case," he said. "Although some points made are valid, they are also standard operating procedure in phylogenetic transmission investigations."

For example, it is important to have a clear *a priori* hypothesis to test, and it is important to blind the identities of samples during the analysis. Clearly, a case cannot rely merely on phylogenetic analysis, Hillis said. There has to be clear epidemiological evidence and a criminal investigation and forensic standards of investigation must be maintained.

Hillis does not dispute that phylogenetic analysis represents circumstantial evidence. "All scientific inferences from data, of any kind, represent circumstantial evidence, by definition. That's the way the analyses are presented in court," he said.

Where Hillis disagrees is that there is any assumption that the phylogenetic tree is inferred without any error. Rather the error is estimated and reported, the same as any other analysis of scientific data, Hillis said.

He also disagrees that everyone who has ever been infected with HIV must be sampled. Rather, conclusions can be supported or rejected on samplings actually performed.

"Given these points, there is no doubt that a phylogenetic analysis of multiple strains from a victim and a suspect, as we conducted in the *PNAS* paper, can indeed support or reject particular hypotheses of transmission between suspected transmission pairs," he said. "The standards of such analyses have been tested and supported in courts of law."

Hillis said no genetic test can provide 100% proof of a hypothesis. Science does not work that way.

"But, the tests can reject or support particular hypotheses to a high degree of significance, just as for other types of genetic testing," he said.

Vandamme, who has testified in over 20 HIV cases, worries that juries may not understand the scientific meaning of "support" of a transmission hypothesis "to a high degree of significance," in the context of *a priori* hypothesis testing.

"I would be more careful to state that the hypothesis of transmission can be rejected or not with a high degree of significance using phylogenetic analysis techniques," she said. Vandamme believes, since phylogenetic analysis alone cannot prove HIV transmission, a statement that phylogenetic analysis supports a transmission hypothesis will convey the impression that phylogenetic data are proving the transmission, even if it is specifically stated that phylogenetic analysis alone cannot prove transmission.

"This is a common misinterpretation," she said. "Rather than stating that the phylogenetic analysis is supporting a transmission hypothesis, it is entirely correct and more prudent to state that the transmission hypothesis cannot be rejected."

Hillis agrees it is important to be clear about what the analyses can and cannot support.

"That point," he said, "is not unique to phylogenetic analysis—it is true of all scientific analyses."

Douglas Page *writes about forensic science and medicine from Pine Mountain, California. douglaspage@earthlink.net*

Social Media and the Changing Role of Investigators

Investigative methods when collecting evidence from social media vary substantially from traditional digital forensic techniques creating new legal and procedural challenges.

Benjamin Wright

Technology is rapidly changing the world. It has changed how we access and share information and how we communicate. Mobile devices and texting, free communication and file sharing solutions (think Skype and Dropbox), and social networks (such as Facebook, Twitter, and blogs) make it easier than ever for people to share information and express opinions.

As today's digital world continues to evolve, so must the way we conduct cyber investigations. Sources of evidence are growing rapidly. For those who fail to keep up, collecting and authenticating evidence during a cyber investigation will prove to be a difficult task. For those with a clear understanding of how to leverage advances in technology and the wealth of information available online, the evidence collected during a cyber investigation can help create a solid case.

Consider social media. Cyber investigations involving social networks are a very new topic. With new applications, links, techniques, and roadblocks discovered daily, social networks are rapidly progressing. Facebook, Twitter, and LinkedIn are just a part of the landscape. There are also many new social networks like Google Plus, Quora, Instagram, Groupon, Pinterest, and LoveIt; and we must not forget the thousands of blogs and special interest forums that exist.

Making Social Media Evidence Relevant

There is so much relevant evidence available on social media. With this wealth of information there are also many new issues which are different from what investigators have dealt with in traditional digital forensics. Previously, digital evidence was extracted from a piece of hardware in the possession of the investigator, such as a computer hard drive or the flash memory on a smartphone. The terms and conditions for dealing with this technology were understood by investigators. If someone challenged how investigators did their work, a third party could easily corroborate the findings by reviewing the same hard drive which the investigator kept in a safe. That is not the case with social media.

Today you might go to Facebook, for example, as an investigator. You are a relatively unwelcome, uninvited guest trying to gather information on someone Facebook considers to be a "good customer." You can look at pictures and dialogue but you can't control the hardware where the physical evidence exists (Facebook does). Social media providers like Facebook are unlikely to turn over this evidence to an investigator (though in some circumstances social media providers are more cooperative with investigators). Further complicating matters, the evidence posted online is changing rapidly; information may be updated or deleted at any moment in time.

Investigator Turns Eyewitness

In today's world of social media, investigators are taking on a new role; they are becoming a form of

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eyewitness. As the eyewitness, an investigator observes evidence that might not be visible to any other available investigator. The investigator is wise to create a record of what he or she sees at any particular point in time, including print outs of screenshots.

Screenshots, combined with written eyewitness reports, are commonly used today to record what an investigator observes in social media. However, the process of making screenshots and written reports is less

Screenshots, combined with written eyewitness reports, are commonly used today to record what an investigator observes in social media

than perfect. Pulling together 25 pages of screenshots off a Facebook wall, creating a report, and detailing each screenshot is time consuming. Ultimately a court or legal authority like a jury will look to you as the eyewitness, to determine what happened and whether they believe you or not.

As with any eyewitness testimony, two corroborating witnesses are much better than one. Therefore if you can get a second person involved you can improve the credibility of the evidence being collected for presentation in the courtroom.

Screencast Records of Investigations in Social Media

Additionally, screencast video recording technology can be very useful in substantiating eyewitness testimony. Several free or low-cost screencast tools are available such as screencast-o-matic, a free Java-based, open-source tool for recording what you see on your screen, and Microsoft's Skydrive free file storage service. When investigators need an efficient way to capture what is happening on a dynamic blog or Facebook wall these solutions can come in handy.

Screencasts enable investigators (as eyewitnesses) to capture exactly what they see on their screen in real-time, including content on a Facebook wall, Twitter page, or other social media outlet. Each item of text, image, sound, and interactivity is captured via video, recorded exactly as the investigator sees it. A second smaller window can be configured to appear on the screencast record to show (via the investigator's webcam and microphone) the investigator narrating what he is doing and seeing each step along the way. From an eyewitness perspective, a screencast video testimonial can be powerful evidence.

Thus, with the webcam trained on the investigator himself, screencast technology serves as an investigative script. In connection with the live collection of evidence, an investigator has the ability to explain on video who he is, his badge number (if appropriate), the methods he is using, the date and time, and a closing signature ("I Ben Wright, investigator, hereby testify that this screencast is my official work…"). In other words, this video/audio signature puts an investigator's professional reputation on the line as he takes responsibility for what he has pulled together and stored. Also lending to the credibility of the webcam signature is the live recording of the face of the investigator, who says directly into the Web cast that he or she is responsible for what was recorded there. This is very powerful evidence for judges and juries. An example of such a screencast video appears at http://bit.ly/ePV9E0.

Screencast technology offers additional residual benefits. For example, if an investigator no longer works for a firm or is not cooperating, the video provides a very reliable piece of evidence on what the investigator saw and when. Additionally, by e-mailing the video to others you can further corroborate the date and time which the video was made via the e-mail time stamp. Alternatively, date and time can be corroborated by posting the video to a third-party service like Microsoft SkyDrive. Locking in the date which the video was created as quickly as possible can prove helpful later as it is very hard for someone to manipulate that record after the date and time has been attached to it through various electronic means.

In today's world of social media, investigators are taking on a new role; they are becoming a form of eyewitness. As the eyewitness, an investigator observes evidence that might not be visible again.

Other Tools and Issues

Additional investigative tools enable investigators to hook into the APIs on Facebook and other sites to collect meta data. Meta data can include all the information normal users don't see on a Facebook wall or blog entry such as time stamps, IP addresses, and other sensitive information. The amount of data some of these tools collect in just a matter of minutes is impressive.

While all of this information gathered from social media sites is extremely useful to investigators and attorneys, one can't help but wonder about the privacy

implications associated with collecting tremendous quantities of information off of someone's Facebook wall, for example. As a lawyer when I think about privacy, I also think about contracts.

Contract terms vary by provider. There are a host of contract terms out there that traditional digital forensic investigators are not aware of nor have they considered. For example, to use Facebook, as with most social media sites, you must agree to their contract. Included within the contract is a term which states you must post a privacy policy if you are using a special application to access API information. However, Facebook doesn't specify where the policy must be posted. Additionally, Facebook states within its terms that if you collect data on a user you must first receive the user's consent.

Ethical Behavior and Restraint is a Must

By now you may be wondering whether or not public information off of Facebook and other social media outlets may be abstracted and submitted as evidence. The short answer is yes, it can. Many investigations today include evidence collected off of social media sites without advanced consent. This evidence is often admissible and used successfully in trials.

So far, the experience has been that privacy and ethical issues have normally caused a problem in only

Many investigations today include evidence collected off of social media sites without advanced consent.

the most extreme social media investigations. For example, while there may be justification for gathering some information available on social media, compiling information dating back seven or ten years that is irrelevant to an investigation is not justifiable. Investigators must familiarize themselves with the concept of proportionality; it is a way of saying "be reasonable" under these circumstances. Yes, you have this information; but is it needed?

The field of social media investigation is very complex. If the means by which you gather evidence is unethical, it may not be admissible. In the brand new world of social media, it is important that investigators exercise an element of restraint and discretion. Ask yourself if you really need to go into a forum posing as someone else or are there other ways to investigate alleged wrongdoing without exposing yourself to potentially violating a site's terms or conditions.

Another lesson: be cautious about using passwords that don't belong to you.

Watch Out for Unexpected Laws

What's more, an investigator should bear in mind that the laws of foreign countries may apply to their investigation. The World Wide Web can be accessed from anywhere in the world. While you may not need to register with a data protection authority here in the States, if you are looking at postings from someone's friend over in France you may be required to register under the terms of the French Data Protection authority before gathering information. European or other privacy laws may apply. Be aware of the laws relevant to any country your investigation reaches.

The Internet leaps over traditional geographic boundaries. As such, we live in a world where it is hard to know when another state's or country's laws apply to an investigation. The laws of that other state or country can surprise an investigator. In Texas, for example, oftentimes someone conducting a digital investigation must first get licensed as a private instigator. This could be a problem if you are an investigator in a state that does not require a license, but your investigation extends via social media into Texas jurisdiction.

In Connecticut, any public identifiers collected electronically must be safeguarded. Therefore, if you are on someone's Twitter feed and you find a student ID number or some other identifiable information, security controls that protect the individual's identity are required. Again, this is where exercising restraint comes in; to manage risk, you are wise to display restraint and proportionality in the scope and methods of your investigation. You should have a logical reason for collecting what you collect.

While social media can prove extremely helpful in gathering evidence for a case, investigators must be very cautious when allowing others such as clients to gather evidence for them. Ask a lot of questions about the evidence before you start looking at it. Make sure the person gathering the evidence did not break laws like computer crime or eavesdropping laws before moving forward. Otherwise the evidence could be contaminated.

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Evaluating the Effectiveness of DNA Analysis on Property Crimes and Identifying a New Model for Outsourcing

Dr. Cecelia Crouse, Julie Sikorsky, Amy Jeanguenat, Teresa Vreeland, Amelia Looper

Available literature shows that habitual burglars commit on average greater than 230 high volume crimes such as burglaries annually, and that the potential to escalate to violent crimes is great. The Palm Beach County Sheriff's Office Forensic Biology Unit (PBSO FBU) has taken a proactive approach to DNA testing the voluminous amount of property crime evidence submitted by Palm Beach County law enforcement agencies. Under this approach, the PBSO FBU has partnered with The Bode Technology Group, Inc. to test Palm Beach County high volume cases for possible DNA profiles, which may be entered into the DNA database and may generate investigative leads. In order to determine if the testing of evidence from Palm Beach County property crimes is efficacious and provide a positive impact on the case backlog, metrics were generated and evaluated from 1,286 cases processed between 2009 and 2011. Criteria included results by evidence type, database eligibility, database hit rates, and cost analysis. Data was obtained for over 3,400 samples. It was determined that the DNA processing of property crimes provided investigative leads by linking evidence to known offenders and to related crimes. As a direct result of this study, an initiative to streamline the process of performing property crime DNA testing has been designed and implemented. This model will serve to decrease the PBSO FBU backlog and case turnaround times by directly involving all Palm Beach County law enforcement agencies in the case submission process. It is important to note that this report concentrates on the tangible results from this study, and does not address intangible metrics such as the number of burglaries that were not committed because a perpetrator was arrested, the amount of money saved because burglaries were not committed due to arrests, the amount of money not spent on increased insurance rates, and others.

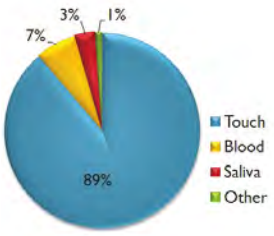

Figure 1: Biological Sources of Evidence. Samples collected from property crimes are 89% touch evidence samples followed by sources of blood and saliva.

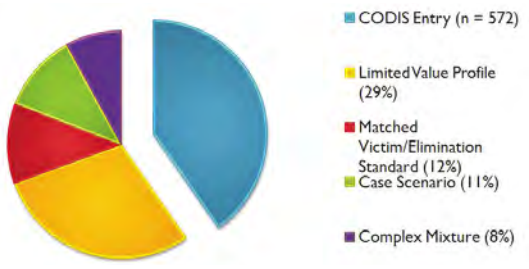

Figure 2: Results of profile evaluation for CODIS entry. Profiles were evaluated for CODIS eligibility and put into categories. 40% of profiles developed were entered into CODIS. Other profiles may not have been entered based on the case scenario, match to victim/elimination standard, or the results contained limited value or a complex mixture.

Introduction

Although the PBSO FBU has regularly tested property crime evidence for DNA, historically testing was only conducted primarily if blood was left at the scene of the crime. Over the past twelve years, the volume of property crimes submitted to the laboratory has increased dramatically as different types of samples, such as touch evidence, have yielded DNA results. To meet the increased demand, the PBSO FBU has made a concerted effort to process these cases not only in reaction to the volume of property crimes that occur compared to violent crimes and the financial loss to residents when crimes against property occur, but also to prevent the potential recidivism of reoccurring offenders.

PBSO FBU property crime cases that are designated as eligible for outsourced DNA analysis

include crimes from home, person, business, and vehicles through burglaries, larceny, arson, theft, shoplifting, and vandalism. These types of cases occur fifteen times more often than violent crime in the Palm Beach County area and are costly to both the victims and law enforcement agencies. According to a 2008 Bureau of Justice Statistics report,[1] the total national economic loss to victims was $1.19 billion for violent crimes and $16.21 billion for property crimes. In 2010, the FBI estimated that the average dollar loss per burglary offense was $2,119 and the total lost for the year was an estimated $4.6 billion.[2] Another concern for law enforcement is the safety of their residents since the analysis of CODIS hits has demonstrated high rates of recidivism and a general escalation in violence among reoffending criminals. An examination of the New York Police Department's first 1,000 hits showed that most were linked to violent crimes, but of these, 82% of the offenders were already in the system for lesser crimes such as burglary.[3] The state of Florida has also experienced similar results with approximately 52% of the violent crime (murder and sexual assault) database hits matching individuals who had prior convictions for burglary.[3]

Pro-Active Strategy and Analysis of Outsourced Property Crime Data

Recently the Palm Beach County Sheriff's Office Forensic Biology Unit compiled data from 1,286 outsourced property crime cases (from 2009 through 2011). Nearly 90% of the samples collected from these property crimes were classified as touch DNA while the remaining biological samples were predominantly blood and saliva (Figure 1). Touch DNA is defined as a biological sample obtained from an item or surface at the crime scene that the perpetrator may have touched, such as a weapon or tool, leaving behind small amounts of DNA. Touch DNA can be left on nearly anything with which a burglar may come into contact during the commission of a crime. With such a significant number of samples containing possible minute amounts of touch DNA, a validated quantification polymerase chain reaction assay was utilized to detect the amount of DNA present in a sample. For all samples resulting in a negative quantification value, processing stopped, which directly translated into cost savings over this time period. Through this "stop-at-quant" approach, approximately 23% of samples in this study were identified as having

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Property Crime Case Example 1

Swabs were taken and submitted from bricks used to smash the steering column of a car. A single source, partial profile was obtained. The partial profile (14 of 16 markers) was suitable for CODIS upload and was entered into CODIS on November 14, 2011. On March 27, 2012 an arrestee sample was entered into CODIS and hit on the partial profile from the brick on March 31, 2012. The individual was arrested for assault and battery.

negative quantification results and therefore no further analysis was conducted.

The remaining 77% of samples continued downstream for processing. Eligible DNA profiles were obtained for 23% of the tested samples and were uploaded into the Combined DNA Index System (CODIS) at

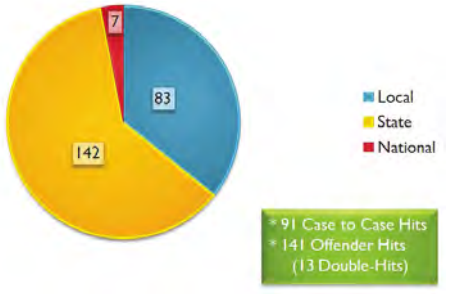

Figure 3: Breakdown of hits obtained per database type. CODIS eligible profiles were searched against the local, state, and national databases as appropriate resulting in 232 hits and a 40% hit rate. The majority of the hits occurred at the local and state level.

the national, state, or local level. The primary reason for database ineligibility was that the samples yielded limited value or partial, uninterpretable DNA profiles. There were also unknown evidentiary samples that matched the victim or exclusionary standards. Of the 572 samples that were entered into CODIS, 235 were touch DNA sample types (Figure 2). Samples that were CODIS eligible and entered into the database were searched against the local, state, and/or national databases and generated a total of 232 hits, resulting in a 40% hit rate (Figure 3). Figure 4 shows the sample types resulting in database hits highlighting that the greatest number was contributed by touch DNA samples. This data unequivocally demonstrates the importance of collecting, submitting, and testing touch DNA evidence, and the potential benefits to law enforcement with regard to generating investigative leads for the ultimate purpose of identifying a perpetrator.

The Denver Police Department compiled a similar study[4] entitled the "Burglary Project" where DNA data from property crime cases from October 2005 through September 2007 was described. The results of this project similarly showed a 41% hit rate. During analysis of CODIS hit outcomes, it was determined that without DNA analysis over 80% of the cases filed for prosecution from CODIS hits would never have been prosecuted. In the end, the Burglary Project resulted in an estimated $41.8 million savings to the community. This savings represented the value of property loss that did not occur as habitual offenders were stopped, as well as the agency savings when police officers did not have to respond to and investigate these crimes. The Burglary Project concluded that every $1 invested in DNA forensics and related fields (police and laboratory training) resulted in the prevention of approximately $90.05 in police expenses and property loss.

Continued Process Improvement

The PBSO FBU has noted that the benefits of processing property crimes are worth the costs. As a result of this comprehensive evaluation of Palm Beach County property crime data, the next logical step was to improve the efficiency of the outsourcing process to provide a method whereby every law enforcement agency has ownership and control of their cases. To this end, the PBSO FBU Direct DNA Initiative has been established in coordination with the BodeDirect Outsourcing program. In the past, law enforcement agencies have requested permission to submit property

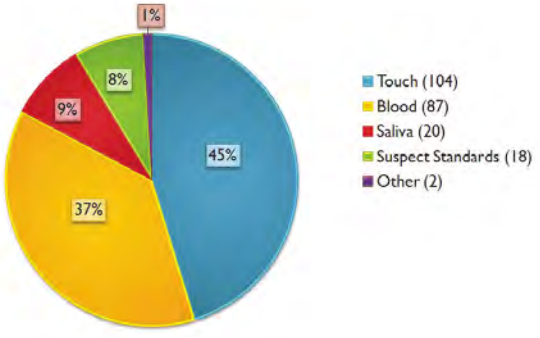

Figure 4: CODIS hits by sample type. Touch evidence can be a good source of DNA and resulted in 45% of the CODIS hits obtained from property crimes. Blood, saliva, and suspect standards were the majority of the other profile types generating hits.

cases to the PBSO FBU, and upon approval, cases were submitted by the law enforcement agency to the PBSO Evidence Unit. The PBSO FBU Evidence Coordinator signed out the cases from the Evidence Unit, prepared a case manifest, and shipped all evidence. Upon completion of the DNA testing, all case file data and reports

Property Crime Case Example 2

In early 2011 a rush turnaround case involving the sexual assault of a minor occurred. Mixture DNA profiles were obtained from items of evidence that were not consistent with the victim. The foreign profiles were entered into CODIS on January 19, 2011. There was an immediate hit from the local database with blood collected at a burglary scene from October, 2009. This investigation is still ongoing.

were sent to PBSO FBU along with the evidence. PBSO FBU would review all documents associated with the analytical data, upload any suitable results into CODIS, and issue a report to the law enforcement agency. The returned evidence would also be inventoried and then returned to the law enforcement agency. In total, the administrative and technical processes took approximately 12 months to complete.

The Direct DNA Initiative provides Palm Beach County law enforcement agencies a means to ship property crime cases directly to Bode. As a part of this initiative, PBSO FBU has introduced a training program that educates law enforcement agencies about what types of samples are CODIS eligible. Under this model, law enforcement agencies evaluate their own cases for eligibility prior to submission. Bode is then responsible for reviewing each case and interacting directly with the submitting law enforcement agency to resolve any questions prior to initiating DNA analysis. Upon the completion of analysis, the evidence and a court-ready report is returned directly to the law enforcement agency. If CODIS suitable results are obtained, a report and data will also be sent to PBSO FBU where the data will be reviewed and if eligible, the DNA profiles entered into the appropriate databases. Once uploaded into a database, PBSO FBU will directly issue a report to the law enforcement agency. It is estimated that the PBSO Direct DNA Initiative will decrease the total property crime processing time from 12 months to 4 or less. Palm Beach County law enforcement agencies can directly outsource burglary, theft, arson, larceny, shoplifting, and vandalism cases.

The streamlined process will allow consistent and faster turnaround times, reduce administrative burdens and evidence handling by the crime laboratory, and benefit citizens by allowing property crimes to be investigated in a more timely manner to ultimately solve crimes and reduce recidivism. Comprehensive metrics under the PBSO Direct DNA Initiative will be collected for a two year period in order to support and evaluate potential impacts.

References

1.Bureau of Justice Statistics, "Criminal Victimization in the United States, 2007," Table 82, http://bjs.ojp.usdoj.gov/content/pub/pdf/cvus07.pdf (accessed September 29, 2011) report update 5/11/2011 for 2008.

2. Federal Bureau of Investigation, "Crime in the United States 2010: Burglary," (Washington, DC: GPO, 2011), http://www.fbi.gov/about-us/cjis/ucr/crime-in-the-u.s/2010/crime-in-the-u.s.-2010/property-crime/burglarymain (accessed September 29, 2011).

3. U.S. Department of Justice. Office of Justice Programs. National Institute of Justice. (2004). DNA in "Minor" Crimes Yields Major Benefits in Public Safety. In Short Toward Criminal Justice Solutions. November 2004 Issue. Retrieved April 17, 2012 from the Department of Justice Web site: https://www.ncjrs.gov/pdf files1/nij/207203.pdf

4. Ashikhmin, S., et al. (2008). Using DNA To Solve High-Volume Property Crimes In Denver: Saving Money, Lowering Crime Rates and Making Denver Safer, The Prosecutor, 42(3), 34 – 43.

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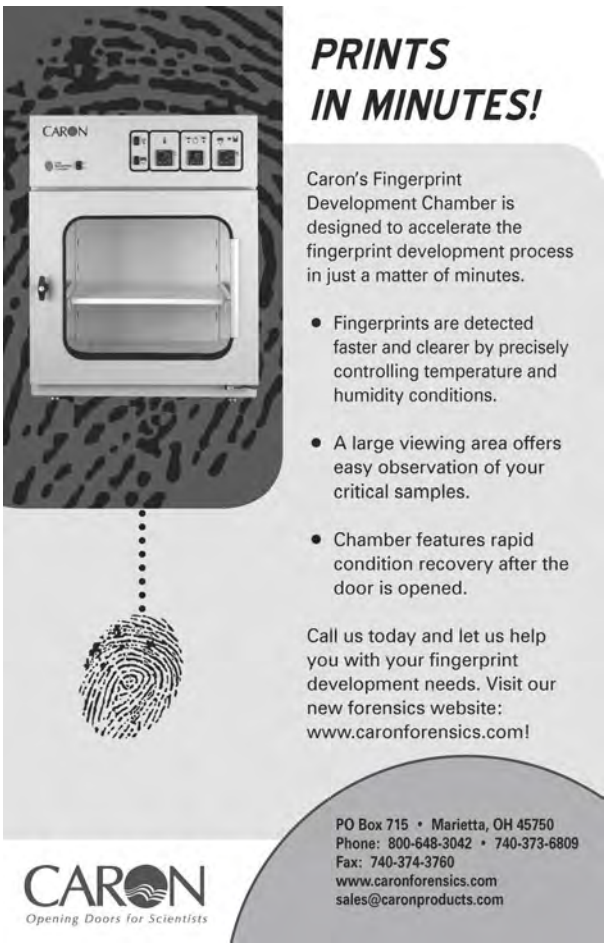
Amelia Looper *has been employed with the Forensic Biology Unit of the Palm Beach County Sheriff's Office since 2010.*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Forensic Laboratory 2030:
Scientific Environment

Mike Mount and Steve Hackman

What will constitute a modern forensic laboratory in 2030? From its physical manifestation to its legal and scientific mandates, the vision for the ideal forensic laboratory in 2030 will likely be dramatically different from the model of today.

Forensic Laboratory 2030

This is the first in a four-part series that reveals how forensic laboratories might be designed in the future based on the findings of the research survey undertaken by SmithGroupJJR—Forensic Laboratory 2030. This article will examine projected changes within the forensic science environment. Future articles will focus on investigative activities, physical environment, and workplace activities within the forensic industry.

Over a two year period, crime lab directors and managers throughout the country were polled with an online survey and personal interviews. The resulting data was collected and organized under the following four categories:

1. **Scientific Environment.** Identified future trends in laboratory organizational structure, effects of the 2009 National Academy of Sciences report, anticipated future challenges, influence on forensic facilities, and emerging technologies.
2. **Investigation Activities.** Explored laboratory investigation methods, advancement in automated technology, use of computers, electronic communication, and the effect of new procedures and equipment on lab practices.
3. **Physical Environment.** Compared influencing factors for laboratory configuration, casework systems, security protocols, specialty needs, and collaboration goals.
4. **Workplace Activities.** Focused on preferences in current lab design, vision for the ideal lab facility, sustainability and energy efficiency, staff amenities, and future challenges.

The following facility stats from participants reveal a representative range of demographics, facility sizes, and ages, including historical and projected growth for staff and caseloads.

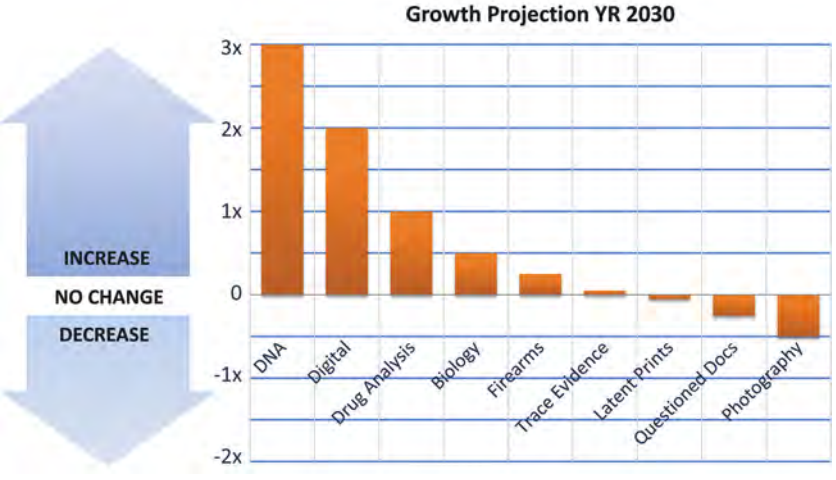

Figure 1: Growth projection for forensic sections by order of magnitude in the year 2030.

- Facility size (gross square feet) ranged from 8,500 GSF to 190,000 GSF with an average of 43,000 GSF.
- Facility age ranged from 5 years to 35 years with an average of 19 years.
- Staff increases over the last 10 years averaged 23% and are projected to grow 44% over the next 10 years.
- Caseloads (differentiated from actual tests) are projected to increase on average by as much as 33% over the next 5 years.

While these and other metrics collected highlight general trends within the forensic community, it is important to note that every facility is unique to its own location and organizational structure—there is no single facility which represents an idealized "average" or one-size-fits-all solution to the complex challenges within the forensic community. The outcome of this survey illustrates the unique pressures and critical requirements that shape the Forensic Laboratory 2030.

Laboratory Reorganization

The future is likely to bring changes to the basic organization of the forensic lab. According to the survey, high costs of maintaining multiple services has driven many facilities to focus on the core sections that will contribute to solving violent crimes. Therefore, high growth lab sections such as DNA, digital forensics, and drug analysis will stay on the rise. Since the mid-1980s, DNA instrumentation has consistently advanced in technology, leading to broader applications for analysis and increasingly shorter turn-around times. In fewer than 15 years, digital forensics, or "computer crimes," has experienced rapid growth and change due to the development of new digital devices. Starting simply with the examination of computers and "floppy" disks, this laboratory section now deals with myriad items of digital evidence, including tapes, CDs, DVDs, flash drives, Blu-ray discs, cameras, cell phones, photocopiers, scanners, smartphones, and tablets. This being a digital age, the survey results project the trend to continue. Additionally, drug analysis sections will grow based on synthetic drug use and the anticipated legalization of some controlled substances. These high growth lab sections will have an impact on the staff, instrumentation needs, and resulting space requirements in the Forensic Laboratory 2030.

According to the survey responses, low growth laboratory sections will be trace evidence, latent prints, and questioned documents. These sections are increasingly being consolidated into regionalized laboratories which provide for the necessary amount of caseload to maintain a workable business model and return on investment. Developing technology that allows DNA to be obtained from a latent print may limit the need for print comparisons even further. In some facilities forensic photography is also merging with digital forensics to maximize cross training and staff productivity.

External Influences

Participants were surveyed about the long term effects of the 2009 Report on Forensic Science by the National Academy of Science (NAS). Among the recommendations for the standardization and improvement of forensic laboratories is the enactment of laws to create a national regulatory organization responsible for monitoring this implementation.

Figure 2: Specialized laboratory support, outfitted for unknown technologies, located adjacent to open laboratory.

Despite the current lack of legislation, there is a trend by many forensic laboratories to voluntarily adopt the NAS goals. In September of 2012, as a step toward operating independently of police and prosecutors, the D.C. Consolidated Forensic Laboratory initiated replacement of police officer/technicians in the Mobile Crime Scene Laboratory with certified and trained civilian technicians. This is much like the structure of labs surveyed in Canada and the United Kingdom.

At least three recommendations from the NAS report have begun to have a significant effect on the administration and organization of forensic laboratories. They include:

- The removal of local law enforcement control over forensic laboratories, a change that results in restructuring of lab administration as well as the source of funding.
- Accreditation requirements for the laboratory as well as certification for the forensic analysts and technicians, requiring additional training lab spaces.
- Uniformity throughout the forensic community of laboratory analysis procedures and services, requiring physical adjustments and changes to accommodate new equipment and procedures.

Figure 3: Instrument lab with adaptable casework systems to meet the needs of new equipment and processes.

Forensic Science Challenges

Responses to the future challenges within the scientific environment—source of laboratory funding, management of increased test volume, recruitment of staff, operational changes in evidence handling, and innovations in technology—were broad ranging with an underlying message that facilities require the capability of adapting to unforeseen changes. "Planning for unknown technologies is the key in government funded laboratories for forensics," indicated Michael Thomas of the National Forensic Science Technology Center. "The challenge is how to accommodate new technologies like automated analysis for DNA investigations in existing space."

Forensic procedures and equipment are continuously evolving. Participants reported a decreased use of wet chemistry procedures and an increased use of analytical instrumentation. The use of automated instruments in drug chemistry, toxicology, and DNA analyses has challenged the makeup and operational functions of these sections. Technological advances will inevitably affect the design of forensic lab facilities for the future. Respondents reported that an increased reliance on the use of automation, robotics, and instrumentation will likely continue. These advances will create a need for specialty trained technicians similar to firearms (IBIS technicians) and latent prints (AFIS technicians). As instrumentation advances, additional sequencers and other analytical equipment, unaffordable in the past, will require more space as caseloads, and individual tests, continue to increase.

New technology also has space-saving advantages. Many new instruments require half of the area needed 15 years ago which allows for much needed internal growth within existing budgets and facility constraints. As instruments become more compact and handheld, scientists and investigators can utilize them directly at the crime scene, further changing the make-up of the laboratory. Spaces that were once reserved for larger equipment are being replaced with areas to maintain, calibrate, and repair portable devices. New wireless devices are resulting in faster processes and less paper. These devices will significantly reduce the need for hard copy files, while slightly increasing the space needs for secure server equipment.

Future Preparation

It is evident from the results of this survey that forensic changes in the scientific environment will parallel technological innovation. These changes will have a significant effect on how a forensic laboratory is designed to accommodate the continuing evolution of information technology. Technology is directly related to the development of instrumentation, automation, databases, crime scene processing, evidence handling, record keeping, as well as the growth of the lab's digital forensics section. The Forensic Laboratory 2030 will need to accommodate spaces for equipment that is becoming smaller, more portable, and less expensive, while considering how to accommodate emerging processes that do not currently exist.

Developments in technology will influence the basic laboratory organizational structure. Some sections will require space for tremendous growth; others will experience minimal to decreasing demand, resulting in realignment with other lab sections or locations that can provide these critical services. The successful development of Forensic Laboratory 2030 involves adaptation at many levels. It involves not only monitoring the advance of technology, but also the political/legal ramifications of funding, management, and operations. In the next article in this series, investigation activities will be explored and the impact that these changes have on forensic laboratory design.

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The DNAscan™ Rapid DNA Analysis™ System has been developed to enable law enforcement agencies to process DNA samples in the police booking station or forensic laboratory and generate results in 84 minutes. The system couples the all-in-one DNAscan BioChipSet™ Cassette, a disposable lab-on-a-chip that is preloaded with all required reagents, with the DNAscan Rapid DNA Analysis instrument.

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www.gehealthcare.com; http://netbio.com

Narcotics Identification System

Mobile Field Lab-3000 (MFL) narcotics identification system enables law enforcement professionals to quickly and easily perform presumptive drug testing in the field without destroying evidence. Simply place and cover the unknown material (solid, liquid, or powder) on the portable device and Centice's patented Raman Spectroscopy technology rapidly scans it and creates a unique spectral fingerprint of the substance.

Centice Corporation
http://centice.com

Semi-automated Diluter/Dispenser

The Microlab 600 is designed to streamline sample preparation and ensure compliance and traceability of results by replacing traditional manual methods, thus reducing time, sample waste, and variation in accuracy. For forensic blood alcohol and urine testing, the Microlab 600 comes with a calibration certificate that is traceable to NIST standards.

Hamilton Company
www.hamiltoncompany.com

the Safety guys

Vince McLeod, CIH

Take This Jar and Store It

Good rules of thumb for chemical handling and storage in the lab

If there is anything that all laboratories have, it is bottles and bottles of chemicals. Forensic laboratories are no exception. If we are not diligent in properly handling and storing these hazardous substances, problems are sure to arise. Potential problems run the gamut from minor inconvenience to life threateningly serious. Keep reading to learn how to avoid mishaps from mishandled chemicals.

Previous Safety Guys articles have laid a foundation for managing chemicals in laboratories. These covered understanding the National Fire Protection Association's (NFPA) hazard diamond, how to decipher material safety data sheets, and constructing a proper chemical inventory for the lab. In this column we provide general safety rules of thumb for handling and storing chemicals in the laboratory.

Aside from the ubiquitous fire codes, many federal, state, and local regulations have specific requirements that affect handling and storing chemicals in labs and stockrooms. Examples include controlled substances regulated by the Drug Enforcement Agency, consumable alcohols covered by the Food and Drug Administration, radioactive substances controlled by the Nuclear Regulatory Commission, and hazardous wastes governed by the Environmental Protection Agency. Requirements range from locked storage cabinets and specific waste containers to secured access for "regulated" areas. Make sure you know which regulations apply and what the specific requirements are for all special chemicals and wastes at your facility.

A more common scenario is applicability of state and/or local building codes, which are becoming more rigorous each year. Hopefully these were identified and attended to during design and construction; but, we all know that labs evolve and change over time within the facility. And, unfortunately the state fire marshal and local codes inspectors are not shy about pointing out were we have crossed the line.

First things first: proper personal protective equipment (PPE)

Before we start grabbing bottles of chemicals and moving them around we need make sure we have the proper PPE. At a minimum this would include appropriate chemical resistant gloves and eye protection. Closed toe shoes are a definite and considered a general requirement for working in any laboratory. Use lab coats or chemical aprons when moving liquids and when required by your laboratory's safety policy.

We have covered PPE, but before we begin rearranging chemical containers in the laboratory there are a couple more things to organize and take note of. First, survey your surroundings and take note of any potential tripping hazards and work stations where others are busy. Make sure exits, passageways, and emergency equipment areas (i.e. eyewash and safety showers) are clear and free of stored materials. Locate and have close at hand a full spill kit with appropriate absorbent materials, neutralizing agents, clean up utensils, and waste containers. Finally, check that all chemical containers have complete labels in good condition and that safety data sheets are readily available.

Tips for safe transportation

Here are a few pointers for moving chemicals safely:

- First, never move visibly degrading chemicals and containers. Report these to your lab supervisor.
- Whenever transporting chemicals, place bottles in appropriate leak-proof secondary containers to protect against breakage and spillage. A good example is using a special plastic tote for carrying four-liter glass bottles of corrosives or solvents.
- When moving multiple, large, or heavy containers use sturdy carts. Ensure the cart wheels are large enough to roll over uneven surfaces without tipping or stopping suddenly. If carts are used for secondary containment make sure the trays are liquid-tight and have sufficient lips on all four sides.
- Do not transport chemicals during busy times such as break times, lunch periods, or class changes (for those academic forensic laboratories).
- Use freight elevators for moving hazardous chemicals whenever possible to avoid potential incidents on crowded passenger elevators. Remember to

remove gloves when pushing elevator buttons or opening doors.
- Never leave chemicals unattended.

General guidelines for chemical storage

Safely storing chemicals in laboratories or stockrooms requires considering many health and safety factors. In particular, proper use of containers and common lab equipment is critical. Here are some general guidelines for safe chemical storage:

- Do not store large, heavy containers or liquids on high shelves or in high cabinets. A good rule is to store these at shoulder level or below.
- Do not store bottles on the floor unless they are in some type of secondary containment.
- Do not store chemicals near heat sources or in direct sunlight.
- Do not store chemicals in fume hoods. Excessive containers interfere with airflow and hood performance. Only chemicals in use should be in the hood.
- Especially avoid storing anything on top of cabinets. This can interfere with the fire suppression system. Ensure at least 18 inches of clearance around all sprinkler heads.
- Do not use bench tops for storage. These workspaces should only contain chemicals currently being used.
- Do not store chemicals indefinitely. Humidity causes powders to cake or harden. Liquid chemicals evaporate. We strongly recommend all containers be dated when they arrive in the lab. Ensure all manufacturers' expiration dates are strictly followed. Pay special attention to reactive or dangerous compounds. Dispose of all outdated, hardened, evaporated, or degraded materials promptly.
- Do label all chemical containers fully. We recommend placing the user's name along with the date received on each one.
- Do provide a specific storage space for each chemical and ensure return after each use.
- Do store volatile toxics and odoriferous chemicals in ventilated cabinets. Please check with your environmental health and safety personnel for specific guidance.
- Do store flammable liquids in approved flammable liquid storage cabinets. Usually only a small amount of flammable liquid is allowed in the open room. Check with your local authority (e.g. fire marshal, EH&S personnel) for allowable limits.
- Do separate all chemicals, especially liquids, according to compatible groups. Follow all precautions regarding storage of incompatible materials. Post a chemical compatibility chart in the lab and next to chemical storage rooms for reference.
- Do use appropriate resistant secondary containers for corrosive materials. This protects the cabinets and catches any leaks or spills due to breakage.
- Do seal containers tightly to prevent the escape of vapors.
- Do use designated refrigerators for storing chemicals. Label these refrigerators CHEMICAL STORAGE ONLY – NO FOOD. Never store flammable liquids in a refrigerator unless it is specifically designed and approved for such storage. Use only explosion proof (spark-free) refrigerators for storing flammables.

Following these simple guidelines will get you well on the way to an efficient, organized, and safely operating laboratory. Ignore them or become cavalier in their application and you may be picking through ashes or ruble one day. Spend a few minutes going through your laboratories with this list on a regular basis and you should avoid any major incidents with chemical storage. As always, Safety First!

Comments or questions are always welcome. Contact thesafetyguys@forensicmag.com.

Additional Resources

1. Standard System for the Identification of the Hazards of Materials for Emergency Response, National Fire Protection Association, Publication 704. www.nfpa.org/aboutthecodes/AboutTheCodes.asp?DocNum=704
2. NIOSH Pocket Guide to Chemical Hazards. National Institute of Occupational Safety and Health. Publication 2005-149. www.cdc.gov/niosh/npg/
3. The Merck Index, an encyclopedia of chemicals, drugs, and biologicals. 14th edition. Merck & Company, Inc. Rahway, N.J. 2006
4. OSHA Hazard Communication Standard - www.osha.gov/pls/oshaweb/owadisp.show_document?ptable=STANDARDS&p_id=10099
5. Prudent Practices in the Laboratory: Handling and disposal of Chemicals. National Research Council. National Academy Press. Washington, D.C. Latest edition.
6. Laboratory Safety Manual, University of Florida, Division of Environmental Health and Safety. 2003 www.ehs.ufl.edu/Lab/LabSafe.pdf

Vince McLeod *is an American Board of Industrial Hygiene Certified Industrial Hygienist and the senior IH with the University of Florida's Environmental Health and Safety Division. He has 24 years of experience in all facets of occupational health and safety and specializes in conducting exposure assessments and health hazard evaluations.*

how it works

Increasing the Sensitivity and Scalability of Forensic DNA Collection

Problem: Advances in DNA testing have grown exponentially in recent years, but the ability to collect sufficient DNA material from the evidence has not kept pace, forcing law enforcement and forensic scientists to use collection methods that may not be the most suitable or ideal for the application and scenario. Porous surfaces such as clothing or other fabrics and rough surfaces like concrete or brick are extremely difficult to collect DNA material from as the surface either tears up the swab or it does not allow the swab to penetrate its recesses enough to collect the target material. Cutting is an option on fabrics, but the surface area that can be covered is very limited, especially in a "touch DNA" scenario when the deposited DNA material is spread over a relatively large surface area.

Evidence processing, whether at the crime scene or at the lab, is a painstakingly long and tedious process that requires focus, determination, and skill. Law enforcement and forensic scientists have done a terrific job making the best of the tools that have been available. despite quite often being in very difficult circumstances. Solving crime is an evolutionary process, like everything else in society, and as better and more sophisticated tools have become available, the professionals in the field take advantage of them and utilize the new tools to produce results that were previously unobtainable.

Until recently, significant technological advances have been made in almost every area except collection. Ironically, forensic DNA collection is one of the most critical steps in the process yet has been mostly ignored in recent decades, focusing more on the middle and back end stages of the detection process. Unfortunately, if the DNA material is not collected at the beginning of the process, everything downstream will have faulty results. The best and most sensitive DNA extraction and PCR amplification procedures are completely negated if the cellular material doesn't make it into the sample in the first place.

Solution: M-Vac Systems has developed a wet-vacuum surface sampling system called the M-Vac, which applies a sterile, DNA-free solution to the surface while simultaneously vacuuming up both the solution and the target cellular material. The M-Vac has consistently produced significantly higher DNA collection results when compared to swabbing and can readily cover a much larger surface area where needed. Increased sensitivity and scalability that could dramatically affect the outcome of cases, combined with a non-destructive collection method, has been unavailable to law enforcement until now.

The M-Vac System and accessories (inset).

The M-Vac System has been around for a while, but is a relatively new sampling method in forensics. The system is designed to be an alternative or enhancement method, especially when the traditional methods are not likely to produce a viable profile, rather than a replacement for the swab or cutting methods. As a new and more sensitive DNA collection method, the gap in capability is what the M-Vac System addresses, particularly in tough cases such as touch DNA or a stain on porous or coarse surfaces like fabric, concrete, or brick. These surfaces are examples of substrates that are exceptionally difficult to collect forensic DNA from, yet substrates where the M-Vac has been shown to collect significantly more DNA than other methods. Blood stains, saliva, and other biological fluids may go uncollected using current methods, but the M-Vac System, with its spray-vacuum combination, in most cases will enable the user to reach those difficult areas and collect the target DNA material. For example, in an M-Vac validation, the M-Vac recovered considerably more DNA than dual swabbing. Specifically, the saliva on polyester fabric yielded 149.2ng of DNA using the M-Vac versus 3.6ng from swabbing.

Crime scene investigators, detectives, and crime lab personnel who are looking to increase their forensic DNA collection capabilities will benefit from obtaining the added capability that the M-Vac System provides. This collection device enables the user to collect more DNA material and dramatically increase the probability of generating a viable profile.

For more information, visit www.m-vac.com.

Most wanted

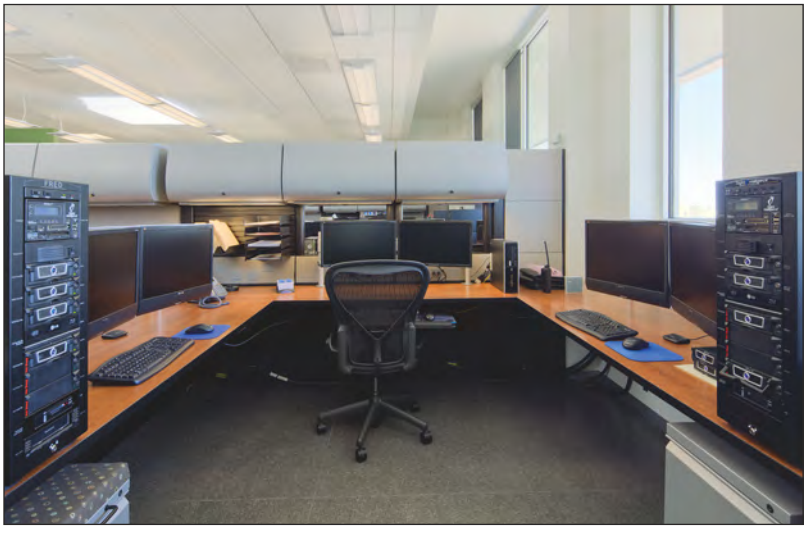
Answers to Facility Issues

Susan Halla

A Bit About Taking a Byte Out of Digital Forensics Laboratories

"…the Internet is the crime scene of the 21st century."
– Cyrus Vance, District Attorney, New York County (Manhattan)[1]

With the invention of new types of digital media comes the introduction of new types of crimes. The ever-present access to the internet by increasingly sophisticated mobile devices allows criminals to act anytime and anywhere. Combating cybercrime is the purview of the digital forensics laboratory—a relative newcomer on the forensic scene. What are the requirements for designing laboratory spaces that best support this ever changing section?



The general surroundings of the computer forensics section are like the other sections within a crime laboratory. The section is secure and accessible only by those who work in it. A bio-vestibule for entry, generally a place to put on personal protective gear, wash one's hands, and provide a negative pressure zone for air flow, into the digital forensics section is not necessary but could be utilized. Finishes in the room may be different than in other sections in the building—carpeting may be used in the main laboratory space provided that it is anti-static. Specialty spaces may still require continuous flooring, particularly if they are wet areas.

Furnishing in the main laboratory space is typically accomplished with specialty furniture systems designed for computer stations. Mechanical systems can be of a recirculating type, different than typical laboratory spaces and more akin to office areas. Mechanical systems should have design concepts in place to ameliorate noise, to provide additional cooling in high computer use areas, and to allow for more laminar-type airflow into spaces where small parts and pieces are being manipulated. Digital forensic laboratories are heavily electrically supported and care needs to be taken in the preparations for clean power, multiple circuits for support, and uninterruptible power supply for power outages.

What other items continue to evolve to support computer forensic laboratories?

Data: While access to data networks is important in all laboratories, the computer forensics section will need to access both the general crime lab network and a separate, stand-alone network within the computer forensics section. Not only is the number of data drops important, but also ease of access to cabling and drop points. While data cabling trays are typically found above the ceiling, the computer forensic section is one area where locating the cabling tray below the ceiling may be advantageous for changes to data cabling. Hard wired data is a thing of the past you say? Quite often we find that while wireless technology is available to other parts of a laboratory, the needs of the digital forensic laboratories dictate the more secure use of direct cabling. Depending on the type of cable used, a wired connection can also provide faster data transfer rates than wireless connections. This is one area that will continue to change as technology evolves.

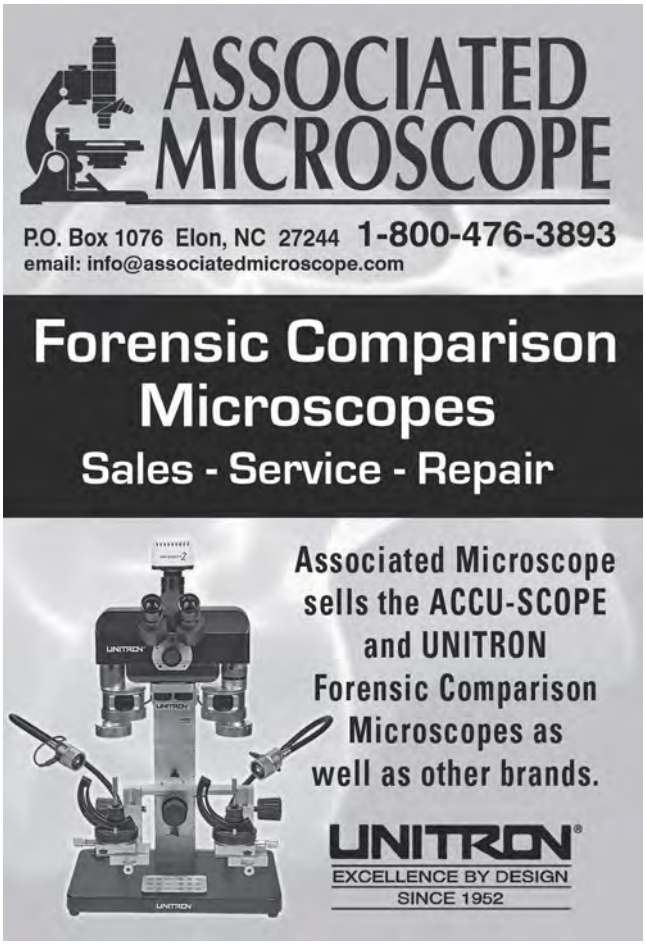
Shielding: Due particularly to the requirement for taking cell phones and other two-way transmitting

devices off-grid, there is a need for areas of the computer forensic section to be shielded from communication with the outside world. There are two basic concepts for shielding, each with their own pros and cons. Some facilities may have the throughput to support, and the preference for, shielding an entire room. This requires special attention in the facility design, to build-in the shielding materials in the floors, walls, roofs, and doors, as well as shielding the room's utility service penetrations and can be quite expensive. An alternative to the built-in approach is the use of a prefabricated shielded room assembled within the building, providing a shielding solution that simplifies the general building construction.

The second concept for addressing shielding requirements would be by the use of faraday boxes—equipment that can sit on benches. Pros of such a solution include the portability of these devices—from bench-to-bench or even the ability to utilize the unit in the field. Cons to the faraday boxes include working on a device through a gloved/portal system and limitations on the size of the enclosure. Certainly a combination of these concepts may be helpful, and the location of the facility in relation to radio frequency signals such as cell towers may also influence design approaches.

Laboratory Notification System: Based on the types of work often found in the computer forensics section of a laboratory, much of this information is sensitive in nature not only from an evidentiary standpoint, but can be disturbing to view or listen to. Tours are common in some forensic facilities and this may include the digital forensics section. While it is possible to arrange laboratory spaces to limit direct lines of sight to computer screens, notification systems are often incorporated to alert the computer forensics personnel of the presence of visitors to the section. There are many ways of providing this notification depending on access policies. If the laboratory is amenable to tours at any time, a signal light system with a switch at the entrance to the lab can be used to signal the presence of visitors in order for laboratory users to protect audio and visual materials. If access to the computer forensic section is limited to times when evidence is not actively being processed, an in use light outside the lab unit can be used to notify the lab tour guide that it is not appropriate to enter the lab at that time. Laboratory notification is also imperative in separate audio and video review rooms where an in-use light outside of those rooms is necessary for controlling entry.

Computer forensics areas will continue to evolve to keep up with the technology that is being employed for criminal activity. The design of space to support such efforts will also continue to evolve based on these changes. Computer forensics laboratories for fighting cybercrime will continue to be built in areas were none exist today. As former Attorney General Janet Reno has said, "Everybody should want to make sure that we have the cyber tools necessary to investigate cybercrimes and to be prepared to defend against them and to bring people to justice who commit it."[2]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References

1. Bray, Chad et al. "Accounts Raided in Global Bank Hack." The Wall Street Journal. Oct. 1, 2010.
2. "Exit Interview with Janet Reno." A NewsHour with Jim Lehrer Transcript. Jan. 18, 2001 http://www.pbs.org/newshour/bb/politics/jan-june01/reno_1-18.html

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Read all the Most Wanted columns @ www.forensicmag.com/most-wanted.

John J. Barbara

Mozilla Firefox Forensics: Part 2

This is a continuation of a discussion on Firefox forensics begun in the Fall 2012 issue of *DFI News*. Read part 1 at www.dfinews.com/article/mozilla-firefox-forensics.

Browser Basics

The most prevalent software applications in use today are probably Web browsers. They are used for viewing, retrieving, traversing, and presenting information resources obtained from the Web. Although browsers are complex software applications, they have common functionality regarding their main components. A simplified overview of their high level structure is as follows:

- **User Interface -** the entire browser display except for its main window.
- **Browser Engine -** takes the marked up content (XML, HTML, etc.) and formatting information (CSS, XSL, etc.) and displays it on the monitor's screen.
- **Rendering Engine -** responsible for displaying the requested content.
- **Networking -** used for network calls (HTTP, etc.).
- **UI Backend -** used for drawing widgets such as windows and combo boxes.
- **JavaScript Interpreter -** software which interprets/executes JavaScript.
- **Data Storage -** a persistence layer consisting of the data that the browser stores on the computer hard drive.

When a URL is entered into the address bar, the browser communicates with a name server to resolve it into an IP address. This allows the browser to connect to the appropriate Web server using HTTP. Once connected, HTTP commands then direct the Web server to retrieve and transmit data back to the browser. The browser reads the HTML and displays the information resources (HTML document, a .pdf file, an image, a video, etc.) which were identified by a Unified Resource Identifier (URI). The browser then saves the Web documents in its cache using Web caching technology. Caching of Web objects reduces the bandwidth usage and server load and allows the browser to retrieve the same Web page much faster when it is visited at a later time. It also allows recently viewed Web pages to be viewed offline and copied although some of the features such as Flash animations and "real time" objects found on the Web page may not function.

Firefox Cache Location

The Firefox cache contains both metadata (information about the various cache entries) and data (the cached items themselves) which can be of immense forensic importance. Cache files are located as follows in Windows 7 and 8:

- C:\Users\[User]\AppData\Local\Mozilla\Firefox\Profiles\xxxxxxxx.default\Cache
- C:\Users\[User]\AppData\Local\Mozilla\Firefox\Profiles\xxxxxxxx.default\jumplistCache
- C:\Users\[User]\AppData\Local\Mozilla\Firefox\Profiles\xxxxxxxx.default\OfflineCache
- C:\Users\[User]\AppData\Local\Mozilla\Firefox\Profiles\xxxxxxxx.default\startupCache

In the C:\Users\[User]\AppData\Local\Mozilla\Firefox\Profiles\xxxxxxxx.default\Cache directory there are four primary internal files:

- **_CACHE_001_ -** stores small metadata and data entries in 512-byte blocks.
- **_CACHE_002_ -** stores medium-sized metadata and data items in 1024-byte blocks.
- **_CACHE_003_ -** stores large metadata and data items in 4096-byte blocks.
- **_CACHE_MAP_ -** contains the index to both the metadata and the data and links them together. A working copy is stored in memory when Firefox is running while the other cache files are continuously updated during Web browsing.

Additionally, there may be any number of external directories/files which are used to store very large metadata items or data.

Viewing the Firefox Cache

Firefox has a built-in feature which allows direct viewing access to cache files. With the Firefox browser running, entering "about:cache" into the address field and pressing the Enter key on the keyboard will load the "Information about the Cache Service" screen. Information concerning the memory cache device, disk cache device, and offline cache device will be displayed and appear as follows:

- **Memory cache device**
  Number of entries

Maximum storage size
Storage in use
Inactive storage
List Cache Entries

- **Disk cache device**
  Number of entries
  Maximum storage size
  Storage in use
  Cache directory
  List Cache Entries

- **Offline cache device**
  Number of entries
  Maximum storage size
  Storage in use
  Cache directory

Both "List Cache Entries" are hyperlinks. Clicking on either one will cause the cached files or objects to be displayed along with their original link location URLs. For instance, clicking on the link under "memory cache device" will display information regarding the key, data size, fetch count, last modified, and expires that is stored in memory. The information is searchable. Clicking on any of the entries will display the "Cache entry information" screen for that entry and provide a wealth of potential forensic information such as:

- **Key -** the URL.
- **Fetch count -** number of times accessed.
- **Last fetched -** yyyy-mm-dd-hh:mm:ss.
- **Last modified -** yyyy-mm-dd-hh:mm:ss.
- **Expires -** yyyy-mm-dd-hh:mm:ss.
- **Data size -** size of the file.
- **File on disk -** none.
- **Security -** document does not have any security information associated with it.
- **Client -** HTTP.
- **Request method -** GET (may or may not be present)
- **Response head -** HTTP, server information, etc. (may or may not be present).
- **Charset -** (may or may not be present).
- **Charset source -** (may or may not be present).

Likewise, clicking on the link under "Disk cache device" and clicking on any of its entries will provide similar information. Clicking on one of the key entries should open the URL or provide other pertinent information. Note that the "File on disk" may point to the directory where it is stored on the hard drive!

The free Firefox add-on, CacheViewer, provides a GUI front end instead of having to use "about:cache." In addition to providing a searching capability for both memory and disk cache files, it includes a sorting functionality to sort the key, size, MIME type, device, and last fetched columns. An additional feature is a preview pane for images and the ability to copy them for later examination. For instance, searching for ".jpg" will provide a list of all the URLs that contain a .jpg and clicking on one of the "key" URLs will display that .jpg image in the preview pane. Right clicking on the key URL will also provide "Open in Browser" and "Save as" functionalities for that .jpg. Alternately, the free standalone utility MozillaCacheView can be used to read the cache folder on a live system or pointed to the location of an external cache. It provides forensic information such as the URL, Content Type, Fetch Count, Last Fetched, Cache Name, Server Name, Server Time, and so forth. The information can be exported to a CSV/Tab-Delimited File or viewed as an HTML Report.

John J. Barbara *owns Digital Forensics Consulting, LLC, providing consulting services for companies and laboratories seeking digital forensics accreditation. An ASCLD/LAB inspector since 1993, John has conducted inspections in several forensic disciplines including Digital Evidence. jjb@digforcon.com*

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www.iamleconf.in

FEBRUARY 5-7, 2013
ACSR 2013 Conference
College Park, GA
www.acsr.org

FEBRUARY 18-23, 2013
AAFS Annual Meeting
Washington, DC
www.aafs.org

FEBRUARY 26 - MARCH 1, 2013
PEAF 2013 Educational Conference
Orlando, FL
http://peaf.us

MARCH 11-14, 2013
Kansas Division of the IAI Spring Educational Conference
Topeka, KS
www.kansasiai.org

MARCH 13-15, 2013
CTIN Digital Forensics Conference
Seattle, WA
www.ctinconference.org

MARCH 23, 2013
Western NC Death Investigation Symposium
Winston-Salem, NC

MARCH 25-29, 2013
CAPE Annual Training
Rancho Mirange, CA
www.cape-inc.us

APRIL 15-16, 2013
FISPhil 2nd Scientific Conference
Puerto Princesa City, Palawan
http://fingerprintphilippines.weebly.com

APRIL 24-25, 2013
Forensics Europe Expo
London, UK
www.forensicseuropeexpo.com

APRIL 29 - MAY 3, 2013
California State Division of the IAI Training Conference
Sacramento, CA
www.csdiai.net

MAY 6-10, 2013
MAAFS Annual Meeting
Roanoke, VA
www.maafs.org

MAY 14-17, 2013
Pacific Northwest Division of the IAI Annual Conference
Tacoma, WA
www.pnwdiai.org

MAY 19-22, 2013
CEIC
Orlando, FL
www.ceicconference.com

MAY 19-24, 2013
California Association of Criminalists Spring Seminar
Pasadena, CA
www.cacnews.org

JUNE 9-14, 2013
IHIA 2013 Symposium
Orlando, FL
www.ihia.org

JUNE 23-28, 2013
AFTE 2013 Seminar
Albuquerque, NM
www.afte.org

JUNE 24-28, 2013
8th ISABS Conference on Forensic, Anthropologic and Medical Genetics
Split, Croatia
www.isabs.hr

AUGUST 4-9, 2013
IAI International Educational Conference
Providence, RI
www.theiai.org

AUGUST 25-28, 2013
20th International Council on Alcohol, Drugs and Traffic Safety Conference
Brisbane, Australia
www.t2013.com

SEPTEMBER 16-17, 2013
The Evidence Conference
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www.theevidenceconference.com

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Who says you Can't do that?

Dick Warrington

Crime Scene Checklists: Customizing the List

In the last issue, I discussed the value of crime scene checklists and provided an overview of the basic checklist. In this issue, I'll discuss how to customize a basic checklist to make it work for specific types of scenes.

Before I show you how to customize a checklist, let's review some key points. In order to be useful, a checklist needs to be both easy to use and comprehensive. Reviewing the forms you fill out for your cases will show you the kinds of information you'll need for your checklist. Once you've figured out what you need, create a master checklist that is detailed but easy to read, and create a template that can be saved and modified as needed.

Once you have your master checklist, you're ready to customize it. Begin by thinking about the crime scenes you deal with. Then consider the following questions for each type of scene: What makes each different? What special or unique kind of information do you need to collect for that kind of case? What steps do you follow? The answers to these questions will help you create customized checklists.

First, let's consider burglaries. In addition to the basic information that we just discussed, you'll also need to keep track of items and processes specific to this type of scene. For example, note who was at the scene, point(s) of entry, point(s) of exit, weather conditions, whether windows or doors were broken or damaged, whether there was other damage inside the scene, and what was taken. As always, make careful note of what items were processed, the method used, and the result obtained. Also remember to set up your form so that it logically follows the way you process the scene. For instance, at burglaries you often find tool marks that you can cast; but before you cast, you need to photograph. To help ensure that you follow all of the steps, put them on the form:

1. Tool Marks Found: Y or N. Describe. Location, Photographed: Y or N.

Casted: Y or N. Material Used.

If you're dealing with a vehicle burglary, turn it into a checklist. Create a generic vehicle diagram. Make sure you include the top (roof), fenders, bottom panels, and sides. Photograph the vehicle using overall, medium, and close-up shots. You may end up with one or two overall shots, a few medium shots, and then close-ups of every place you find evidence. Wherever you find a print, be sure to mark it on your diagram. That way your diagram and photos will tie together. This kind of professionalism and attention to detail is essential in court cases.

You can also customize a checklist for assaults. For these cases, record where the assault occurred, who was there, how the scene was secured, information about the victim(s), and injuries to the victim(s). Include any information about weapons if they were used in the crime. Trace evidence can be crucial to these cases, so be sure to note whatever is found. In many instances, you'll need to collect clothing and other items that may contain evidence. If the case involves rape, collect things like sheets, bedding, or any other items that may contain evidence of the assault or may be traced to a suspect. Here's an example of a checklist for victim injuries:

1. Victim #1 Injuries: Y or N. Describe injuries. Describe where injuries occurred. Photographed: Y or N.

For rape cases, also include a checkbox for the rape kit.

Of course, for major crime scenes the checklist becomes even more important and much more complicated. For example, at a death scene you need a vast amount of information beginning with the type of death—suicide, homicide, accidental, natural, or undetermined. Other things you need to track include search warrants issued, the people present at the scene (including all experts, officers, civilians, lawyers, etc.). You also have to note special equipment or technology used and who used it. Record everything related to the body itself—from where it was found to the evidence on and around it, to the people involved (including the coroner, the people who remove the body, other experts, etc.). And the list goes on and on. Your job is to get it down thoroughly and accurately. For a detailed look at building such a list, refer to a series of articles that I wrote for *Forensic Magazine* in 2005 , see the full list at www.forensicmag.com/tip/checklists.

I can't stress enough what a difference it will make if you have that checklist ready to go before you arrive at the scene. We all know that crime scenes can be chaotic, and in the midst of that chaos, it's all too easy to overlook a crucial step. Even when we're working the seemingly "simple" cases, it's easy to get distracted and miss a step. Don't let that happen to you. Take the time to design a set of customized checklists that work for you. You'll stay on track, and you'll be prepared when you get to court.

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